HARDWARE MEMO 4
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A/D AND D/A CONVERTERS, A PROGRAMING DESCRIPTION

New A/D and D/A converters have been installed on the PDP6/10 multiplexed I/O buss. Features include test mode, programable clock rates, A/D sequential channels, and A/D packing modes.

The A/D has 200 channels and a twelve bit resolution. The computer may specify a particular channel to be read repeatedly or specify an initial channel from which the A/D control will sequence automatically. This is controlled by the SEQUENCE bit in the CONO to the A/D. The A/D will convert either one or three times before becoming DONE, depending upon the state of the PACK bit in the cono. If PACK is a one, then three twelve-bit bytes of A/D information are packed into a thirty-six bit word for the DATAI. The first conversion is in the leftmost byte in this case. If PACK is a zero, one twelve-bit byte is read before becoming DONE, and is DATAI'ed in the low order twelve bits. The CONO also specifies a rate at which conversions are to occur. This rate may be set from ten to two hundred fifty-six jiffies where one jiffy is about one microsecond. Setting this rate lower than about ten causes the A/D to convert at its maximum rate, about ten microseconds.

CONO 574,

33-35	PIA
30	PACK. Causes three conversion to be packed per DATAI.
29	SEQUENCE. Causes A/D channels to be converted in sequence.
19-26	RATE. 8 bits or period between conversions.

CONI 574,

33-35	PIA
32	DONE set if finished either one or three conversions depending on PACK bit
30	PACK set if in PACK mode
29	SEQUENCE set if in sequencing mode
28	TEST set if test mode switch is on. The program will find the A/D most uncooperative if this bit is on.
0	Set if this processor can access this device.

DATAO 574,

29-35 Set the channel number in random access mode, or the initial channel number in sequential mode.

DATAI 574,

PACK MODE:
0-11 First channel converted
12-23 Next channel
24-35 Final channel

NON-PACK MODE:
24-35 Channel converted

Note: Any CONO will reset conversions in progress and reset the sequential channel number to the contents of the initial channel number (from the DATAO). DATAO merely sets the contents of the initial channel register.

If in random access mode instead of sequential mode, the channel number is reset from the initial channel register at the start of each conversion. Hence the new channel should be DATAO'ed before the previous channel is DATAI'ed.

The D/A converter provides facility for setting one of twenty eight D/A channels to a fourteen bit value. The numbers of the available D/A channels are 2-17 and 22-37 (no, those aren't my fault). The interface also provides a programable clock to time the conversion rate. This clock is driven from the same frequency source as the A/D clock, and so if the timer register in the two devices are set equal, the converters should stay synchronized.

CONO 570,

33-35 PIA
19-26 TIMER REGISTER, in jiffies

CONI 570,

33-35 PIA
32 DONE, i.e. the clock has run out
0 Device available to this processor

DATAO 570,

11-17 CHANNEL NUMBER (yes, Virginia, there are all those bits)
25-35 Dac value for that channel

Note: DATAO 570 may be done at any time, asynchronously with anything else and not lose. It will be totally ignored if the A/D and D/A are in TEST mode.

TEST Mode

The TEST mode switch is located between bays delta and epsilon in rack phi. In the up position the computer has access to the D/A and A/D and in the down position the D/A and A/D are set into TEST mode. In TEST mode the A/D cycles through all channels at the maximum rate. When it comes across a channel with a D/A channel number corresponding to it, the D/A channel is loaded with the value of the A/D channel, and the next channel is converted. This provides a simple way to test out servo motors and to move around the larger motors without computer aid.

Note: As a general rule, most pot boxes have some servo motor connected to the pot when it is in TEST mode. The feedback pots of most D/A servo commands are 100+the channel number of the D/A converter.

D/A CHANNELS

2 AMF ARM SWING
3 AMF ARM VERTICAL
4 AMF ARM HORIZONTAL
5 AMF ARM ROLL (WE SHOULD LIVE SO LONG)
6 AMF ARM YAW (")
7 ALLES HAND TILT
10 ALLES HAND EXTEND
11 ALLES HAND ROTATE
12 ALLES HAND GRASP
13

14	BNC CONNECTOR 1
15	BNC CONNECTOR 2
16	BNC CONNECTOR 3
17	BNC CONNECTOR 4
22	HAND B TILT
23	HAND B ROTATE
24	HAND B EXTEND
25	HAND B GRASP
26	HAND B FINGER 1
27	HAND B FINGER 2
30	TDR HORIZONTAL
31	TVC IRIS
32	TVC FOCUS
33	CANNON LENS ZOOM
34	CANNON LENS FOCUS
35	CANNON LENS IRIS
36	TVB PAN
37	TVB TILT

A/D CHANNEL NUMBERS

2	JOYSTICK CONSOLE AMF SWING
3	JOYSTICK CONSOLE AMF VERTICAL
4	JOYSTICK CONSOLE AMF HORIZONTAL
5	JOYSTICK CONSOLE AMF ROLL
6	JOYSTICK CONSOLE AMF YAW
7	JOYSTICK CONSOLE ALLES HAND TILT
10	JOYSTICK CONSOLE ALLES HAND EXTEND
11	JOYSTICK CONSOLE ALLES HAND ROTATE
12	JOYSTICK CONSOLE ALLES HAND GRASP
13	
14	BNC CONNECTOR 1
15	BNC CONNECTOR 2
16	BNC CONNECTOR 3
17	BNC CONNECTOR 4
20	
21	
22	HAND B TILT
23	HAND B ROTATE
24	HAND B EXTEND
25	HAND B GRASP
26	HAND B FINGER 1
27	HAND B FINGER 2

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30        JOYSTICK CONSOLE POT BOX 4, TDR HORIZONTAL
31        TVC POTBOX MANUAL IRIS
32        TVC POTBOX MANUAL FOCUS
33        POT BOX 2-6, CANNON LENS ZOOM
34        POT BOX 2-7, CANNON LENS FOCUS
35        POT BOX 2-8, CANNON LENS IRIS
36        POT BOX 2-1, TVB PAN
37        POT BOX 2-2, TVB TILT

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62        TVC POT BOX 3
63        TVCPB 4
64        TVCPB 5
65        TVCPB 6
66        JOYSTICK X
67        JOYSTICK Y
70        NEW POT BOX 1
71        NPB 2
72        NPB 3
73        NPB 4
74        NPB 5
75        NPB 6
76        NPB 7
77        NPB 8
100
101
102       AMF ARM POT SWING
103       AMF ARM POT VERTICAL
104       AMF ARM POT ROLL
106       AMF ARM POT YAW
107       ALLES HAND POT TILT
110       ALLES HAND POT EXTEND
111       ALLES HAND POT ROTATE
112       ALLES HAND POT GRASP

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122       HAND B POT TILT
123       HAND B POT ROTATE
124       HAND B POT EXTEND
125       HAND B POT GRASP
126       HAND B POT FINGER 1
127       HAND B POT FINGER 2
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130	TDR VERTICAL
131	TVC IRIS POT
132	TVC FOCUS POT
133	CANNON LENS ZOOM POT
134	CANNON LENS FOCUS POT
135	CANNON LENS IRIS POT
136	TVB PAN POT
137	TVB TILT POT
140	LVDT 1
141	LVDT 2
142	LVDT 3
143	LVDT 4
144	LVDT 5
145	LVDT 6
146	LVDT 7
147	LVDT 8
